



***2004 Naval Safety Center Aviation
Maintenance Safety Conference
NAS Norfolk, VA
27 - 29 April 2004***

***Onboard Oxygen
Generating System
(OBOGS)
Bill Struble***



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CDR Russ Lawry AOS Team Tier II IPTL
(301) 757.6976

russ.lawry@navy.mil

Bill Struble AOS Team Tier III IPTL/APML
(301) 342.9237

william.struble@navy.mil

Deborah Johnson AOS Team DAPML (301)
342.8481

deborah.a.johnson@navy.mil



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Key Points of Contact: Patuxent River

Engineering:

- Jean-Pierre Petitjean (301) 342.8474 jeanpierre.petitjea@navy.mil
- Luis Gierbolini (301) 342-9212 luis.gierbolini@navy.mil
- Dennis Gordge (301) 342-8419 dennis.gordge@navy.mil

Technical:

- Larry Eckert (301) 342.9051 larry.eckert@navy.mil
- Mike Hoey (301) 342.9050 michael.hoey@navy.mil
- Dennis Goss (301) 757-3211 dennis.goss@navy.mil

Data Analyst

- Deborah Edgmon (301) 342.9220 deborah.edgmon@navy.mil



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Key Points of Contact: Lakehurst (Support Equipment)

Engineering:

- Sam Delserro (732) 323.4720
- Paul Klein (732) 323.2963
- Man-Wai Wong (732) 323.7895

sam.delserro@navy.mil
paul.klein@navy.mil
manwai.wong@navy.mil

Logistics:

- Ray Bungay (732) 323.4210

raymond.bungay@navy.mil

Contract Support (Pax)

- Curt Stansfield (301)862-1993

cstansfield@

spectrumsciences.com

Ext. 143



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OBOGS HYPOXIA REPORTS:

Started with VFA-106 MISHAP (April 2001)

- No clear determination of cause
 - Hypoxia considered a contributor
- During validation of new Leak Adapter and draft procedures (IMP IA.4) in December 01, AOS Team uncovered massive leaks in F/A-18C/D and F-14D 02 delivery system.
 - 3 of 4 F/A-18 aircraft
 - 1 F-14D
 - Additional aircraft confirmed during FITWING check



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OBOGS HYPOXIA REPORTS (continued):

- COMFITWINGLANT and COMSTRKFITWINGLANT directed squadrons to perform a torque verification check to correct immediate (massive) leaks. That was followed up with a formal AFB (500).
- Inventory of available SE (74D470010-1001) to perform platform leak checks indicated an acute shortage (in cal, insufficient assets etc.)
- Basis for decision to field new OBOGS Leak Adapter Kit (3248AS 300-1)





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OBOGS HYPOXIA REPORTS (continued):

- AOS Team assembled and PMA-241/ PMA-265 delivered to F-14D and F/A-18 platform managers 166 Leak Adapter Kits. Additionally, PMA-265 procured and delivered nitrogen bottle/cart To F/A-18 squadrons/facilities to support test requirement.
- Platform pubs updated to reflect new leak check procedures and SE.
- **Meanwhile:**
 - Hypoxia incidents continued to be reported.
 - AOS Team received over 20 reports of Hypoxia and accompanying Engineering Investigations.



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OBOGS HYPOXIA REPORTS (continued):

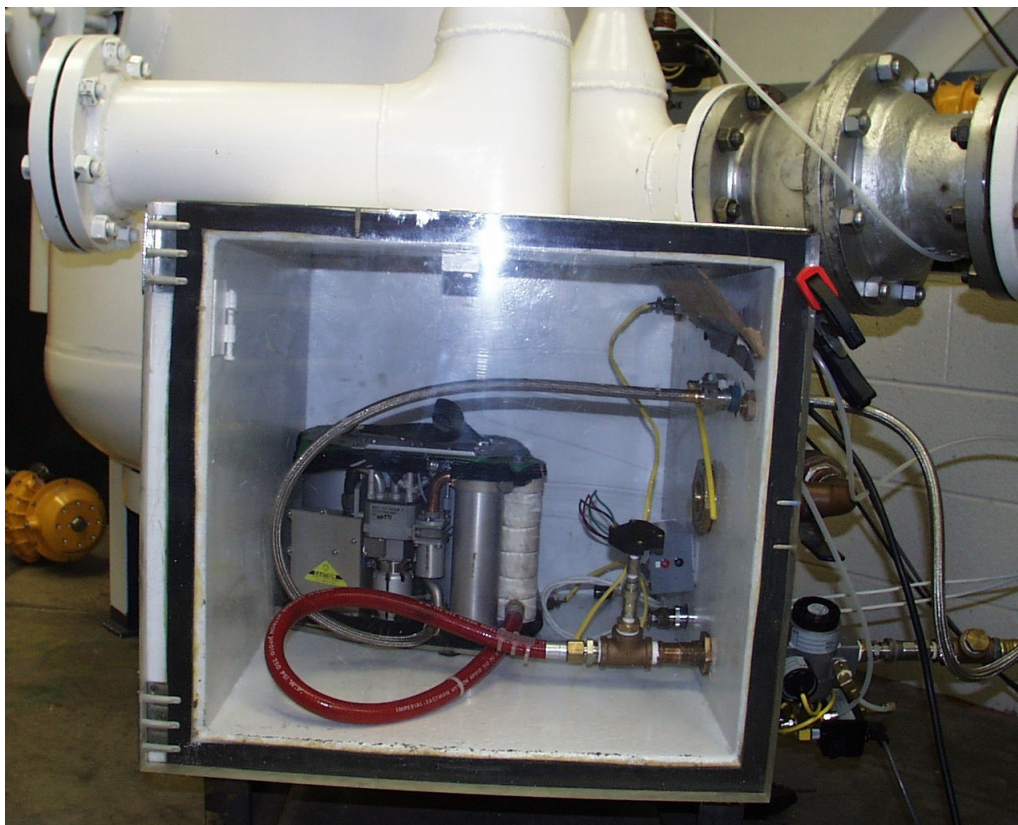
- AOS Team , in addition to standard EI procedures , increased the scope of testing of components to testing as an operating system at altitude. Initially conducted at MFG Depot, (Northrop Grumman LS), NAVAIR/NAWCAD developed the ability to perform these altitude tests in-house.
 - 2 altitude chambers
 - Concentrator operating @ aircraft altitude
 - Cockpit enclosed equipment (SSOM, Crewmember, O2 Regulator etc.) @ cabin altitude



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OBOGS HYPOXIA REPORTS (continued):

- EI's have confirmed no failures of OBOGS equipment, or that it has been a contributor to the reported Hypoxia.
- **What Has been found (Hardware).**
 - Leaking oxygen product lines
 - Defective Secondary Bleed Air Pressure Regulating and Shut-off Valves
 - ECS Controller
 - O2 Hose Console Quick Disconnect
 - Aircraft w/History of ECS problems



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OBOGS HYPOXIA REPORTS (continued):

- **What has been found (Human Factors).**
 - Aircrew unfamiliar with function of equipment
 - CDR Harm Rabb Factor
 - Pre Flight procedures not being performed
 - Warnings being disregarded
- **What was done to mitigate:**
 - PMA-202 Message released Pt 1 and Pt2 (050943Z Mar 02 and 051043Z Mar 02) providing detailed OBOGS SITSUM.



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OBOGS HYPOXIA REPORTS (continued):

- **What was done to mitigate:**
 - A NAVAIR Tiger Team was established that conducted training and familiarization of the abilities, limitations, care and feeding of OBOGS (aircrew and maintainers) at all CONUS USN/USMC Air Stations supporting OBOGS.



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OBOGS HYPOXIA REPORTS (continued):

- **Results:**

- Expanding of testing requirements
- NAVAIR Tiger Team Visits
- Recognition by all of the interdependency of OBOGS and the supporting ECS system

Have Greatly Reduced the reported Hypoxia Incidents.

But!!!!



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OBOGS HYPOXIA REPORTS (continued):

- The AOS Team was STILL not satisfied that we had investigated everything that could have caused the reported hypoxia.
- The next step was to verify the quality of OBOGS product Crewmember is receiving.
- OBOGS Source and Product Air samples were obtained from F/A-18 C/D Aircraft@ NAS Oceana VA



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OBOGS HYPOXIA REPORTS (continued):

3 Aircraft (Lot 13, Lot 19 and an F/A-18D)

3 sample locations per aircraft:

OBOGS Source Air Inlet (ECS)

OBOGS Concentrator Outlet (Product)

Oxygen Regulator Inlet (Crewmember)

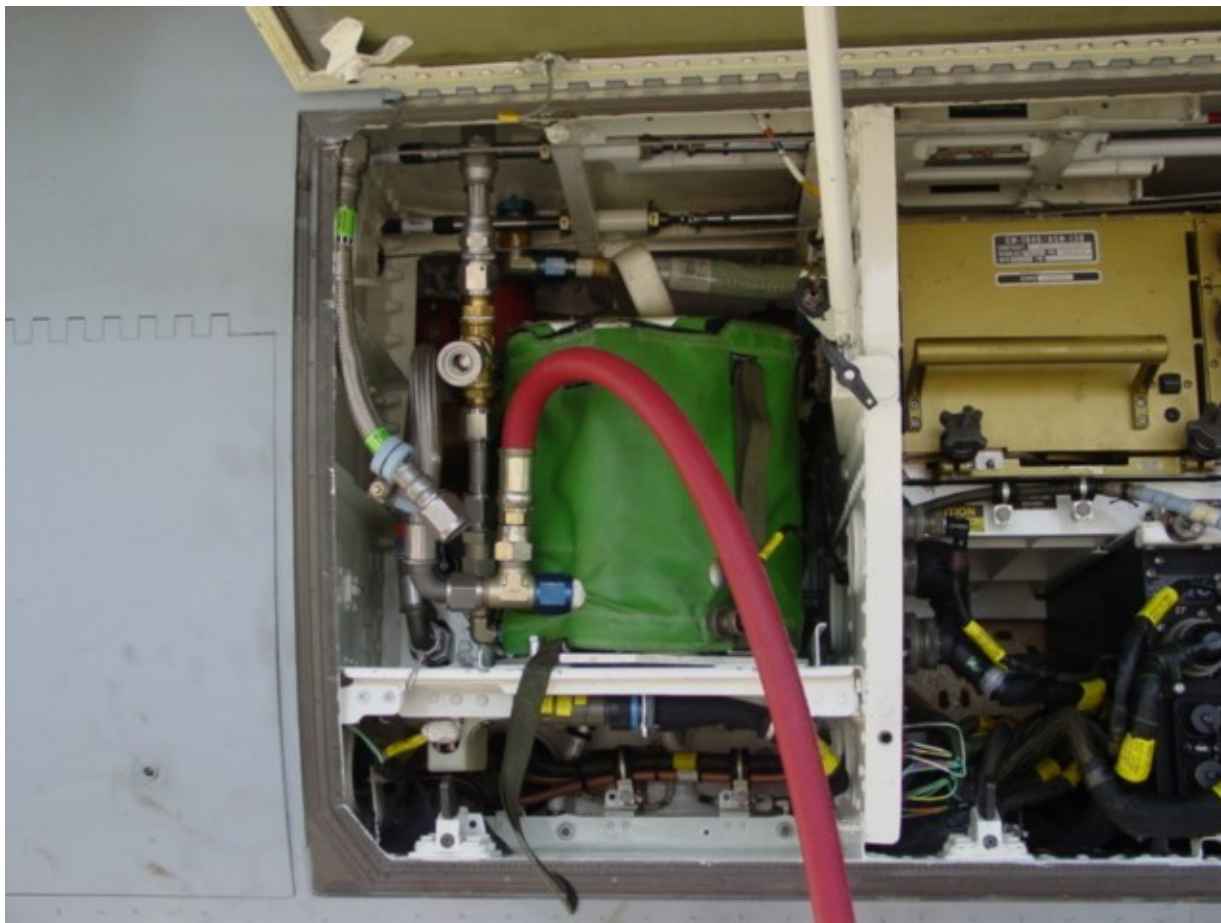
2 power settings

Idle

80%



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OBOGS HYPOXIA REPORTS (continued):

2 Crewmember Configurations

Mask On

Mask Off

Total samples :

12 samples F/A-18D (VFA-106)

12 samples F/A-18C (VFA-131)

06 samples F/A-18C (VFA-34)



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OBOGS HYPOXIA REPORTS (continued):

- Those gas samples were analyzed @ AIMD NAS Oceana VA using the ABO Analyzer.

Conclusions:

- OBOGS Concentrator is removing contaminants to an acceptable level for aircrew consumption.
- With mask off, crewmember is breathing ECS air with an unacceptable level of contaminants and will negatively affect the performance and product of the concentrator and crewmember.



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BACKGROUND (Initial HRI = 10):

- **HOSE FAILURES RESULT IN UNRESTRICTED LOX FLOW INTO COCKPIT INJURING AIRCREW DUE TO LOW TEMPERATURE BURNS. HOSE FAILURES RESULT IN REDUCED OXYGEN FLOW TO THE CREWMEMBER CAUSING THE POTENTIAL FOR HYPOXIA**



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- **Action Taken:**

- Conducted In house Engineering investigations on failed oxygen hoses as submitted by fleet.
- Conducted on-site investigation @ NAS Oceana with support from COMSTRIKEFIGHTWINGLANT
- Independent investigation conducted by Hydraflow on 6 hoses from VMFAT-101



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- **Results of investigations:**
 - Failures occurred due to stress and age
 - Contributing factor:
 - Severe bend when Regulator Hose is connected to Survival Kit Hose while wearing SV-2
 - No defined Check and Test procedures or service life
 - Unacceptable twisting of hoses created during hook-up



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Results of investigations: (continued)

- Impact while crewmember is wearing AIRSAVE Vest was also evaluated
- Ability to adjust Regulator location eliminated the severe bend.



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• **Corrective Actions to Date:**

- To track periodic check/test and life limits , serialization of hoses had to be established.
- Message (DTG 161259Z DEC 03) implemented and defined hose serialization requirements
- Specific Check and Test procedures for Regulator Hose have been written and distributed (NAVAIR 13-1-6.4-1 Chapter 15, CD-ROM Date Jan 04, available to fleet on NATEC Website March 04)



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- Survival Kit Hose procedures are in development
- Oxygen Hose (Survival Kit and Regulator) Life limit being defined. Impact to fleet has been evaluated and phased implementation needs to be defined to prevent adverse fleet impact.
- In response to VFA-83 HAZREP (DTG 122223 Dec 03) specific Regulator hose B-Nut torque has been defined for OBOGS Hose. Specific regulator hose orientation has also been established. To minimize/eliminate hose twisting during hook-up.
- IRAC to NAVAIR 13-1-6.7-3 being developed.



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Questions?

